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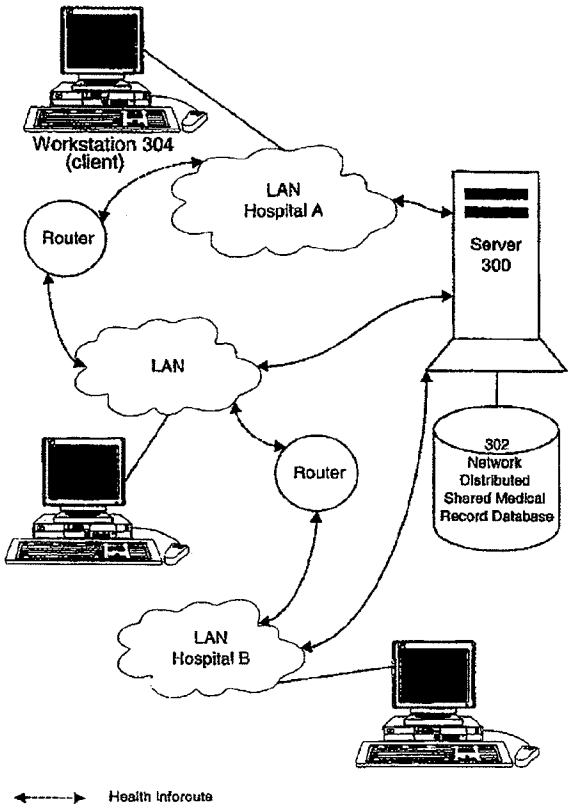
(54) Title: METHOD AND APPARATUS FOR THE MANAGEMENT OF DATA FILES

(57) Abstract

The present invention provides a network system for storage of medical records. The records are stored in a database on a server. Each record includes two main parts, namely a collection of data elements containing information of medical nature for a certain individual, and a plurality of pointers providing addresses or remote locations where reside other medical data for that particular individual. Each record also includes a data element indicative of the basic type of medical data found at the location pointed to by a particular pointer. This arrangement permits a client workstation to download the record along with the set of pointers which link the client to the remotely stored files. The identification of the basic type of information that each pointer points to allows the physician to select the ones of interest and thus avoids downloading massive amounts of data where only part of that data is needed at that time. In addition, this record structure allows statistical queries to be effected without the necessity of accessing the data behind the pointers. For instance, a query can be built based on keys, one of which is the type of data that a pointer points to. The query can thus be performed solely on the basis of the pointers and the remaining information held in the record.



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TITLE: METHOD AND APPARATUS FOR THE MANAGEMENT OF DATA FILES

FIELD OF THE INVENTION

The present invention relates to the field of information distribution systems. More specifically, it pertains to a device and method for the electronic management of data files, for instance within the medical and health education domains.

BACKGROUND OF THE INVENTION

The following paragraphs give definitions of terms relevant to this document:

Client-Server: Client-server computing implies that a single application is being jointly accomplished by two or more interdependent pieces of equipment, including software, hardware and interface. The client requests information and the server provides it, with each one assigned the portion of the job which is suitable to its capabilities. Client-server can be achieved in a local area network of personal computers and servers or by means of a link between a user system and a large host such as a mainframe. Typically, a client-server environment implies a many to one design, whereby multiple clients can make simultaneous requests of the server, allowing for server information sharing between clients. A crucial aspect of Internet Protocol (IP) based technology, such as the World Wide Web (WWW), is the fact that it is a client-server application.

Intranet: An intranet is any internal network (LAN or WAN) that supports Internet applications - primarily web (hypertext transfer protocol), but also other applications such as FTP (file transfer protocol). Intranets are used by many companies to deliver private corporate information to internal users.

Local vs. Wide Area Network: A local area network (LAN) is a private internal communication network that is confined to a small area, such as a single building or a small cluster of

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buildings. It is a general-purpose local network that can serve a variety of devices, and is generally owned, used, and operated by a single organization. A wide area network (WAN) is similar to a LAN in that it is also a communication network, but a WAN extends over a much broader area, interconnecting communication facilities in different parts of a country. A WAN may also be used as a public utility.

Open System: A system with the capability to cooperate with another system in the exchange of information and in the accomplishment of tasks, where the two systems may be implemented very differently. Every open system must conform to a minimal set of communication and protocol standards, as defined by the open-systems interconnection (OSI) model.

Standard Exchange Protocols: A protocol is the set of rules or conventions governing the way in which two entities cooperate to exchange data. An example of such a protocol is the Internet Protocol (IP), a library of routines called on by various network communications applications.

In the past few years, the worlds of information and technology have made important evolutions. We have progressed from a universal analogical support, usually on paper, towards a theoretically universal electronic support based on the multimedia as well as Internet Protocol (IP) based technology such as the World Wide Web (WWW), JAVA and ICQ (I Seek You). The transmission of information has also made tremendous progress and is already, or will be soon, practically instantaneous no matter the form of information: text, data, sound, fixed or animated image.

The search for information is becoming more and more similar to the concept of navigation among diverse sources of information and even within documents themselves. The concept of navigation itself implies the need for user accessible tools as well as some sort of structured organization.

Narrowing the focus, this major revolution of information systems brings about profound changes in the relations between academic and hospital domains, in particular everything which deals

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with medical archives and databases as well as the ability to consult aggregates of these in a transparent way and to share in real or delayed time the information obtained. The number of information sources is multiplying and the communication networks are proliferating: more and more documentation is available in digital form and the information highway is rapidly expanding. Concerning medical archives and databases, questions arise as to their role of maintaining or distributing information. If their roles of acquiring, cataloging and maintaining information are to continue, they will have to give access to the available information on new multimedia supports as well as serve as access points to the information within enlarged networks (e.g. the healthcare inforoute). These changes will add to the complexity of their management, all the while enlarging their traditional mandate.

In other words, the medical archives and databases of the future will not only be locally archived medical-legal clinical documents, but also high-performance data banks of primary importance to the practice of medicine and health care everywhere within our network, all the while constituting a living core dedicated to clinical and scientific research and development.

The above described evolution of the medical file and database system requires that the following two objectives be achieved:

- effective navigation across multiple and diverse sources of information, both local and distant, performed in a transparent way with respect to the end user;
- efficient file management allowing universal research, the treatment of contained information, and the sharing of information between system users.

Currently, in order to store medical archives and databases, passive data accumulation for each medical facility takes place within a local network. Unfortunately, the costs of stocking information and storing files in a local network are quite high and the space available is limited. There is also a well established historical insufficiency concerning the ability of the local medical archive file networks to respond to the documentary and

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informational needs of the emergency doctor or of the consultant. The medical facilities do not have access to a complete ensemble of information sources, thus complicating emergency medical procedures and diagnoses all the while hampering the facility's ability to give patients the most appropriate treatment.

Although the solution of combining the multiple independent local networks into a single integrated health network seems rather obvious, the implementation of such a concept presents certain problems concerning the manner in which medical data is currently recorded and treated, at both text and image levels. First of all, each separate medical facility may count up to hundreds of thousands of active files, some archived locally, others externally, either in an integrated or a refined form. Second of all the file organization may be different at each facility, a huge obstacle to the merging of all files into a system which supports a common format file organization. There is also the problem of available space when considering the large volume of information contained in each file and the fact that the life of a particular medical file may approach up to twenty-five years in length. Thus volume and merging problems lead to the conclusion that it is currently almost impossible to combine and digitize the whole of all local medical records from all local networks.

Even if the merging and digitizing were possible, there is a question as to whether this would be desired. The data recorded in the medical files does not all have the same informational and discriminatory value in the long run. In fact, the data falls into three categories: data with strict medical-legal value, data with short term clinical value and data with historical value or a biological signature. Unfortunately, the first category, data with strict medical-legal value, makes up the majority of data recorded in the file while it represents the least valuable information for emergency doctors and consultants. On the other hand, the most valuable information for emergency procedures and diagnoses, the third category, makes up a very small portion of data recorded in the file. Therefore an integrated file management system which combines all of the information currently held in archived medical files would be extremely inefficient in terms of usage of space,

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thus impairing the extraction of information pertinent to a particular research.

The background information herein clearly shows that there exists a need in the industry to provide a method for developing the information highway to allow for access to shared medical files in an enlarged health network and other external databases in order to increase the number of available sources of information for doctors and consultants.

OBJECTIVES AND SUMMARY OF THE INVENTION

An object of the present invention is to provide a system and method for electronic management of data files.

Another object of the invention is a computer readable storage medium containing a data structure that holds information.

As embodied and broadly described herein, the invention provides a computer readable storage medium holding a data structure, said data structure comprising at least one record associated with a certain individual, said record including:

- at least one unique identifier associated strictly with the certain individual;

- at least one pointer, said pointer using the URL addressing system to indicate the address of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

- at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

In a preferred embodiment, the computer readable storage medium is a database containing a large number of medical records for respective individuals. The information in each record includes at least one attributed identifier distinguishing one record from another one. The record also contains one or more

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pointers, where these pointers use the URL addressing system in order to point to remote sites holding files that contain information in digitized form pertinent to the individual. That information may be blood tests, electrocardiograms among many other possibilities. Each pointer provides an address that is machine readable to import the data residing at the target location. Associated directly with the pointer is a data field, possibly stored in a mapping table in the memory of the NDSMR server, where this data field contains data indicative of the basic nature of the information held in the file or resource to which the pointer is directed. For the purposes of this specification, the term "associated" implies that the data field is either in a direct one-to-one mapping relationship with the pointer or, alternatively, is integrated with the pointer address to form the actual pointer data structure. Each record may also contain a collection of data elements which provide medical information that is intended to be stored in the record for easy retrieval. This information is typically data that is not likely to change during the lifetime of the individual. In a specific example, the data can include, among others, biological data pertinent to the individual, for instance blood type.

In use, the database can be remotely queried to extract the record associated with a certain individual. Typically, this operation can be performed over a network, where a client workstation requests the record from a server managing the database. The server will transfer over the network links the record that will be displayed on the client workstation. The information displayed includes the collection of data elements permitting to identify the person, as well as any medical data stored in the record, where this data is more or less of a static nature. The operator at the workstation, typically a physician, will also observe one or more pointers to files holding additional medical data. The second part of each pointer, the data part, indicates to the physician the basic nature of the data pointed to. He can therefore select the pointers of interest in the global set of pointers for that record and import the data through any appropriate data transfer protocol.

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This arrangement allows the establishment of an electronic medical file system of distributed nature where the bulk of the data is held at sites remote from the central database. Those remote sites are typically the locations where the data would be collected, such as hospitals. Accordingly, the system is very flexible as the records can be maintained even when a patient seeks medical attention and treatment at different sites. Take the example of a patient that visits Hospital A where an electrocardiogram is taken. The electrocardiogram is digitized, by simple optical scanning, and a file created in a local network of Hospital A. An archivist then accesses the remote database and adds a new pointer entry to the patient's record. If, at a later date, the patient visits another hospital, say Hospital B, for the same procedure, another file is created and the appropriate entry made in the patient's database record. Thus, the bulk of the medical data is retained in various locations, yet it can be easily accessed through the pointers' structure.

Although the invention is better suited for applications where the medical records of patients are held in a database, the same inventive principles can also be used for applications where a single record is stored in the machine readable storage medium. Such a storage medium could be a portable memory device, of the so called "Smart Card" type. The portable memory device includes a single record, however, the data structure is the same, namely a collection of data elements of static, medical nature and at least one pointer toward a location containing additional medical information. To use such a portable memory device, it suffices to provide a suitable reader to extract the information contained therein and then to process the information accordingly, such as by remotely accessing and importing the data pointed to by the pointer(s).

As embodied and broadly described herein, the invention also provides a network server, including:

- a processor;

- a memory including:

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a) a plurality of records associated with respective individuals, said record including:

i) at least one unique identifier associated strictly with the respective individual;

ii) at least one pointer, said pointer using the URL addressing system to indicate the address of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

iii) at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

b) a program element including individual instructions, said program element implementing a functional block comprising means responsive to a request to transfer a particular record of said plurality of records towards a client connected to said server through a data communication pathway for locating the particular record and transferring the record toward the client over the data communication pathway.

As embodied and broadly described herein, the invention also provides a network system for distributed storage of records, said network system including:

- a server managing a database, said database containing a plurality of records of respective individuals, each record including:

a) at least one unique identifier associated strictly with the respective individual;

b) at least one pointer, said pointer using the URL

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addressing system to indicate the address of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

c) at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

- a plurality of nodes remote from said server, said nodes being connected to said server through data communication pathways, said nodes constituting locations pointed to by pointers in records of said database and including machine readable storage media holding the data pointed to by pointers in record of said database.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a generic client-server environment, where clients and server are linked by a local area network (LAN);

Figure 2 is a flowchart which describes the current diagnostic process that takes place in medical facilities;

Figure 3 is a block diagram of the health inforoute integrated with the Network Distributed Shared Medical Record (NDSMR) System, in accordance with the invention;

Figure 4 is a flowchart which describes the diagnostic process which will take place in medical facilities under the NDSMR System;

Figure 5 is a block diagram of a general client-server architecture;

Figures 6A, 6B and 6C represent the NDSMR document layout in accordance with a particular embodiment of this invention;

Figure 7 is a block diagram of a server in accordance with this invention;

Figure 8 is a flowchart of the program element in accordance

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with this invention;

Figure 9 is a flowchart of the update process performed by the archivists on the NDSMRs, in accordance with this invention;

Figure 10 is a block diagram of the search engine (query) process implemented by the NDSMR system.

DESCRIPTION OF A PREFERRED EMBODIMENT

Figure 1 illustrates a generic client-server environment, enabled by a local area network (LAN). Client-server computing is a cooperative relationship between one or more clients and one or more servers. The clients 104, 106, 108 and 110 submit requests to the server 102, which processes the requests and returns the results to the clients. Although the processing is initiated by the client(s), both client(s) and server cooperate to successfully execute an application. Therefore, the interaction between the client and the server processes is a transactional exchange in which the client is proactive and the server is reactive. In addition to clients and server, the third essential component of the client-server environment is the network. Client-server computing is distributed computing. In other words, users, applications, and resources are distributed in response to business requirements and are linked by a single LAN 100 or by an Internet of networks.

Currently, most medical facility archives still operate on a paper based support system. However, the higher end medical facilities are set up with their own LAN for archiving medical files, and the computing system is often modeled after the client-server system shown in Figure 1. Since each separate facility has its own LAN for archiving files, the accessibility to files of a particular LAN is limited to the workstations linked to that particular LAN. Figure 2 depicts an example of the current state of affaires faced by medical facilities. Assume an ambulance delivers an unconscious patient to the ER at step 200. At step 202, the doctor makes an initial diagnosis, but needs access to the patient's medical history in order to prevent any misdiagnosis.

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If the patient is without identification of any kind, the doctor has no other recourse but to administer a treatment at step 208 based on a diagnosis that is potentially inaccurate because it has been established strictly on the patient's current medical condition, without taking into account his/her previous medical history. If the patient does have an identification of some kind, it can be used to cross-reference all of the hospital's medical files, archived locally and/or at assigned external archives, at step 206. The patient's file will only be found if the patient was previously treated at the same hospital and already has a file stored in the network server's database. If the file is not found, the doctor is back to step 208. Even if the file is found, it is often incomplete and inaccurate as it lacks the information concerning treatment(s) administered in other medical facilities. Therefore, at step 212 the doctor must make a final diagnosis and perform the corresponding treatment.

Figure 3 depicts an integrated health network embodying the principles of this invention. For the purposes of this specification, the word "integrated" implies the implementation of internetwork communication between all of the various medical facility LANs, as well as with external sources such as the global Internet, the pharmaceutical network, on-line medical libraries and journals, among many other possibilities. An important component of this network is a Network Distributed Shared Medical Record (NDSMR) system that includes two main components, a server 300 and a NDSMR database 302, with the potential for each LAN within the health network to be connected to the server 300. Alternatively, the system may include more than one server, all operating inter-cooperatively in order to manage the NDSMR database, a resource shared by all of the servers. Although such integrated medical networks may be restricted to a particular geographical region, due to differing medical jurisdictions within a country or between different countries, it is an integration hurdle which could eventually be overcome as a result of a concept of the current invention known as an individual's biological signature, to be described in detail below. The integration of medical facilities could thus someday be national wide, or even international wide,

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thereby enlarging and improving the health network.

Figure 4 is a flowchart depicting the improved diagnosis process as a result of the present invention. Assume that an ambulance delivers an unconscious patient to Hospital A. Also assume that the patient is a network user of the health network, and therefore has a personal file stored in the NDSMR database. After the doctor makes his initial diagnosis at step 402, the patient is checked for identification.

If the patient does have identification, his/her network validated or attributed identifier will be known at step 408. In the most preferred embodiment of this invention, such an identifier consists of the patient's medical insurance number such as the one available in a number of countries of the world, including Canada. Alternatively, the identifier may consist of the patient's social insurance number, Smart Card, or any other network attributed identification. A Smart Card is an integrated circuit based card containing individual specific medical information, to be read from and written to by appropriate electronic means, and offers several implementation alternatives to the NDSMR system, to be described in more detail below. If the patient does not have identification, his/her biological signature can be obtained as a universal identifier at step 406. In the most preferred embodiment of this invention, such an identifier consists of a fingerprint derived signature. The technology needed for the implementation of system user identification via a fingerprint derived biological signature could be software similar to that created by and available from delSecur, a Montreal based company. Alternatively, the identifier may consist of a patient's retinal or genetic derived signature, or any other type of biological signature.

At step 410 the doctor sits down at workstation 304 and logs onto the server 300, as will be discussed below. When prompted, the doctor uses the identifier obtained at either step 406 or step 408 in order to request the patient's NDSMR from the server 300. The record is transmitted from the NDSMR database 302 to the doctor's workstation. Once the doctor has read the pertinent medical information found in the record, he/she can scan a list of

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pointers appended to the record. As will be further described below, these pointers represent various significant medical documents (such as x-rays, surgical reports, etc.), and by their textual or visual representation allow the doctor to determine which of the pointers refer to documents pertinent to the patient's current medical condition. Specific to this example, the doctor decides at step 414 that a pointer referring to the most recent electrocardiogram taken at Hospital B would be helpful for diagnosis, and at step 416 he/she activates the corresponding pointer. Consequently, the document is downloaded over the health network from Hospital B's LAN to the doctor's workstation.

Figure 5 is a general representation of the client-server architecture that implements the NDSMR system. The system includes three main components, notably the client 304, the server 300 and the NDSMR database 302. In both client 304 and server 300, the basic software is an operating system running on the hardware platform. The platforms and the operating systems of the client and server may differ. Indeed, a key component of the NDSMR system is that through client-server computing a multitude of different types of operating systems may exist within the various medical facility LANs. As long as the client 304 and server 300 share the same communication exchange protocols and support the same applications, the lower-level differences are irrelevant. It is the communications software which enables clients and server to interoperate. Specific to the NDSMR system, the communication exchange protocol adopted will be an open, non-proprietary protocol, for instance the Internet Protocol, a standard exchange protocol in client-server networking, or any other similar progressive communication exchange protocol.

For the purpose of this specification, the term *interoperate* implies, among other things, the ability of different system users (clients) to share server information and have on-line consultations, in both real and delayed time. Real-time computing is defined as the type of computing in which the correctness of the system depends not only on the logical result of the computation but also on the time at which the results are produced. Real-time tasks therefore attempt to control or react to events that take

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place in the outside world. As these events occur in "real time", a real-time task must be able to keep up with the events with which it is concerned. On the other hand, delayed-time tasks are not at all concerned with the outside world events, delayed-time system correctness depending solely on the logical result of the computation. The benefits of real-time medical consultations in the case of emergencies are very obvious. Take for example a doctor at Hospital C conferring with a doctor at Hospital D that is remote from Hospital C. Both doctor's can share access to an individual's NDSMR, simultaneously studying the record, visible on both of their workstations, and communicating in real-time with each other via some sort of text, voice or video communications link, for instance an Internet messaging window, from their workstations. The equipment necessary to allow for such real-time communication will not be described in detail, as there are a variety of products available on the market that could be used for this task and that are well-known to persons skilled in the art.

The server 300 is responsible for maintaining the NDSMR database, for which purpose a database management system module is required. A variety of different applications that make use of the database may be housed on the client machines. The operative relationship that ties clients, such as client 304, and server 300 together is software that enables a client to make requests to the server 300 for access to the NDSMR database 302. It is important to note that the division of work between a client 304 and server 300 may be allocated in a number of ways. In a preferred embodiment of this invention, the system implements cooperative processing, whereby the application processing is performed in an optimized manner by taking advantage of the strengths of both client and server machines and of the distribution of data. Although such a configuration is quite complex to set up and maintain, in the long run this configuration offers greater user productivity gains and greater network efficiency. Alternatively, the system may be implemented with server-based processing or client-based processing. In server-based processing, the most basic class of client-server configuration, the client is mainly responsible for providing a user-friendly interface, whereas nearly

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all of the processing is done on the server. In client-server processing, virtually all of the application processing is done at the client, with the exception of certain data validation routines and other database logic functions that are best performed at the server. This latter architecture is perhaps the most common client-server approach in current use. In the interest of clarity, the server-based processing implementation is described in the remainder of this description; however, the NDSMR client-server division of work may be any one of the options described above.

Figure 7 is a more detailed block diagram of a preferred embodiment of the server 300, which has the responsibility of managing, sorting and searching the NDSMR database 302. Towards this end, the server is provided with a memory 720, high-speed processor/controllers 708, 710 and 712 (assume for this example that there are three), and a high-speed input/output (I/O) architecture. The I/O architecture consists of the interfaces 702, 704 and 706. An internal system bus 711 interconnects these components, enabling data and control signals to be exchanged between them. The server has 6 ports, identified as port A, port B, port C, port D, port E and port F. These ports connect the server to physical links 1, 2 and 3, allowing data to be transported to and from various clients within the network. In the example shown, ports A, B and C are input ports on the physical links 1, 2 and 3, respectively, while ports D, E and F are the output ports on those same physical links. The input ports are designed to receive data from their associated physical links, while the output ports are designed to transmit data over their associated physical links.

The interfaces 702, 704 and 706 interconnect various input and output ports to the physical links 1, 2 and 3, respectively. Their function is to transmit incoming data packets to the internal system bus 711 for transport to the memory 720 where they can be processed by one of the processors. On the output side, the interfaces are designed to accept data packets from the system bus 711 and impress the necessary electrical signals over the respective physical links so that the signal transmission can take effect. It is not deemed necessary to discuss this standard

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operation of the interfaces 702, 704 and 706 in more detail because it is well known to those skilled in the art and is not critical to the success of the invention.

The memory 720 contains a program element that controls the operation of the server. That program element is comprised of individual instructions that are executed by the controllers, as will be described in detail below. The program element includes several functional blocks that manage several tasks. One of those functional elements is the Database Management System (DBMS) 714 which provides efficient and effective use and maintenance of the NDSMR database 302. The DBMS will not be described in detail because it is well known to those skilled in the technological field to which the present invention belongs.

Besides the program element, the memory also holds the usual routing table that maps the destination addresses of incoming IP data packets (inherent to the IP communications exchange protocol) to the server output ports. It is not deemed necessary to discuss the structure of the routing table here because this component is not critical for the success of the invention and also it would be well known to a person skilled in the technological field to which the present invention belongs. The memory also provides random access storage, capable of holding data elements such as data packets that the processors manipulate during the execution of the program element.

Another component stored in the memory 720 is a validation table, which maps all of the registered user IDs to a corresponding passwords. The table is used to validate clients logging on to the server, for security purposes. One of the characteristics of cooperative or client-based processing is that a system feature such as user validation would not necessarily be exclusive to the server, but could also take place, in whole or in part, at the client workstation. This would remove from the server a part or all of the burden of dealing with invalid clients, thus increasing system speed and efficiency. The identification table associates with each user a unique user profile that specifies permissible operations and NDSMR accesses, in order to limit access to data

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held within the database. Specifically, the table is used to identify between clients with different user privileges, for instance clients with archivist status as opposed to basic user status. Archivist status accords the client with read and write status, including editing and modifying privileges, for updating the NDSMRs. User status limits the client to NDSMR read status only. Finally the memory 720 contains a request queue which is a buffer memory space of the FIFO type, although alternative types of buffer memory space may also be used, that can hold data packets to be sent to one of the controllers for processing. The physical configuration of the buffer does not need to be described in detail because such a component is readily available in the marketplace and the selection of the appropriate buffer mechanism suitable for use in the present invention is well within the reach of a person skilled in the art.

In a most preferred embodiment of this invention, the NDSMR database 302 is part of the memory 720 of the server 300, as shown in Figure 7. In this embodiment, the NDSMR database 302 is actually on a separate storage medium, such as a non-volatile medium interconnected through a high speed data bus with the memory 720 so the record set from the database 302 can be quickly loaded in the random access memory 720 for processing. Alternatively, the collection of data which makes up the NDSMR database 302 may be stored remotely on one or a set of physical storage device(s), for instance a disk. In such a case, one of the server's device drivers would be responsible for communicating directly with the peripheral device(s) in order to access the database.

Figure 8 provides a complete flowchart illustrating an example of the operation of the program element stored in the memory 720, and executed by any one of the processor/controllers, that regulates the operation of the server 300, specifically its interaction with the clients as well as with the NDSMR database 302. Although the server program is running at all times, if no clients are logged on to the server then it is in an effective perpetual wait state, shown at step 800. Once a client attempts to log on, control is passed to the validation functional bloc that is part of the program element in order to ensure that the client

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is a server registered user at step 804. Validation consists simply in ensuring that the user's ID is known to the system (exists within the validation table) and that the user knows the correct password associated by the system with that ID (mapped by the validation table). If either the user's ID is not known to the system, or the password given is incorrect, validation will fail and the user refused possibility of logging on to the server. This is a basic validation procedure that is widely used. Evidently, more complex validation methods can be implemented, if the level of security demands it. Next, the server waits for a request from any of the logged on clients at step 806. When a request does occur, it arrives as a flow of data packets at interface 702, 704 or 706, over physical link 1, 2 or 3, respectively. At step 810, the request is stored in the request queue found in memory 720, to await its turn for processing. The program element next releases a request from the queue (the oldest request) to any non-busy processor. If all of the processors are occupied, the release step is held-up until such a time where any of the three processors is available.

Once a request has been released to a processor, the program element reaches step 814, whereby the requesting client is identified by the identification logic stored in memory 720. The identification logic first reads the request data packet header in order to determine the destination address for the response to the request, specifically the address of the requesting client which is read from the *source* field, and second assigns correct status to the client (user, archivist or other status). This status is determined by the user profile, read from the identification table stored in memory 720. Step 814 also includes routing logic, whereby the routing table is accessed in the memory 720 in order to determine the correct output port for transmitting a database response to the particular client.

At step 816, the processor must determine the search parameters specified by the request. These parameters consist in a patient's identifier and/or a list of other qualifiers (for instance a particular treatment, medical condition, age group, sex, etc). Control is passed to the DBMS logic at step 818, at which

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point the search is performed on the NDSMR database. The DBMS not only performs the search on all data contained within the NDSMR database, but also controls access to specific records or even portions of records within the database, ensuring that confidential data or specific confidential parts of the data being accessed is masked when returned to the client, based on the user profile determined at step 814. The data returned by the NDSMR database search is transmitted over the pre-determined output port and to the appropriate client at step 820.

As indicated above, an aspect of the current invention is the user-friendly interface provided at the client workstation 304. This interface facilitates the user's attempts at making requests of the server, through easy to follow prompts and an on-line knowledge system to help the user with any questions or problems. The interface allows the user to perform searches or queries on the NDSMR database, using information filters to simplify the extraction of pertinent data from what may be hundreds of thousands of network distributed shared medical records. The interface also allows the user to perform keyword-based Internet-wide searches, transparent to the user. For example, a workstation user could initiate an Internet search for all documents relating to a particular medical condition by simply inputting the name of the medical condition as the keyword, the search results returned to the user being a list of hypertext links to all corresponding Internet documents. The software used to implement this interface feature has been previously created by the University of Quebec at Montreal (UQAM), and is marketed under the name of Manitou or SV3. Finally, the interface offers text processing tools, necessary to the editing, publication and merging of all data received from both the Internet and the server 300. Future variations to the NDSMR system may include a more progressive interface at the client workstation. Specifically, a three-dimensional view of the human body may be available to doctors and consultants logged on to the NDSMR server, used for making requests, medical enquiries and searches.

The Network Distributed Shared Medical Record itself is another element. The NDSMR is an evolving summary medical document

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for a particular individual, integrated in the form of a network accessible document. By "summary", this implies that the record does not necessarily contain all the information currently found in local network medical archives. Rather it is a compendium of critical medical information pertinent to a particular individual, potentially useful in the medical diagnosis of an individual's state of health and corresponding treatment. The NDSMR is therefore a shared minimal record, offering a common communication interface to medical facilities that may be using incompatible information systems. It has the merit of being able to be consulted easily, at a distance, on an emergency basis, as opposed to the current situation of files archived in a local network but inaccessible to any users in other networks.

In a preferred embodiment of this invention, the NDSMR includes at least one universal or network attributed identifier, distinguishing one record from another, and a dynamically updated list of biological data pertinent to the individual, accessible by pointers referring to the local network where the data is actually being stored. This biological data consists of significant medical documents in an electronic format such as laboratory tests, x-rays, surgical reports, electrographic data, etc. Alternatively, other embodiments of the NDSMR may also include a variety of other medical information pertinent to the individual. Figures 6A, 6B and 6C display a possible layout for the NDSMR as a WWW document, presenting several categories of medical information pertinent to an individual, in this example John Doe. The individual's identifier is indicated at the top of the record, as seen in Figure 6A. Figures 6B and 6C display other categories of information, including:

- administrative medical data (date of birth, home and work address and phone number, emergency contact, regular physician, etc);
- permanent biological data (blood type, genetic markings or deficiencies, tissue antigens, etc);
- significant antecedents (family medical history, personal medical history, surgical history, etc);

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- current medical condition (allergies, medication, etc).

The final category seen in Figure 6C consists of the dynamically updated links to other biological data. The eight pointers listed refer to other medical documents pertinent to John Doe which are maintained in different local networks, and which can be downloaded from another network site to the client workstation by invoking the downloading operation embedded in the pointer, thus specifying the address of the site (and if necessary of a particular file at that site).

In addition to the set of pointers, the NDSMR could also offer access to complementary external sources of information, transparent to the workstation client. Potential sources could be pharmacy networks, medical libraries or journals, accessible to the doctor or consultant via references within the NDSMR seen on their workstation. Assume a consultant has downloaded John Doe's NDSMR from the server 300, and is verifying the Medication(s) Used reference under the Current Medical Condition category, seen in Figures 6C. When the consultant invokes the Medication(s) Used reference, for instance by clicking with the computer mouse on the hypertext link, the NDSMR system will automatically generate user authorization in order to access an Internet published Medical Library that may be held on an Internet site containing this information, thus allowing the consultant to look up the specifics concerning John Doe's current medication.

In accordance with this invention, the data structure of the pointer allows the workstation user, such as a doctor or consultant, to determine the general nature of the information to which the pointer is referring. In other words, the doctor can tell by simply looking at the pointer whether it points to a medical document concerning a pulmonary x-ray, an electrocardiogram, allergy tests, etc. In a preferred embodiment of this invention, the pointer representation, as seen on the screen of the client workstation, is as seen in Figure 6C. The textual representation of the pointer indicates clearly to the user the medical document or information to which the pointer points, whether it be the most recent or a previous electrocardiogram,

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coronarography, x-ray or brain CT scan. Alternatively, the pointers may be of a graphical representation, small icons used to specify relevant body parts and illustrate medical treatments. The scope of this invention also includes all other variations of a pointer representation implementation which reveals the nature of the information to which it points. Transparent to the user is the actual address, hidden beneath the physical representation, which is the actual device needed for contacting and downloading from various external LANs and other sources, to be discussed in more detail below.

In short, the NDSMR record is data structure that contains two types of elements, namely a collection of medical data elements about the individual and one or more pointers that allow additional information to be downloaded, this additional information being of a medical nature and complementing the data held in the collection of medical data elements. Specific to this invention, these pointers adopt the URL (Universal Resource Locator) addressing system, allowing to point to a specific file in a directory, where that file and that directory can exist on any machine on the integrated health network and can be served via any of several different methods, specifically the Internet technologies such as ftp, http, gopher, etc. The URL addressing system is well documented and very well known to those skilled in the art, and therefore will not be described in more detail.

Each pointer provides an address which may consist in the entire address information of the file pointed to by the pointer or in a reference to the address information, where the reference may be an index in a table that contains the address information. Associated directly with the pointer is a data field, possibly stored in a mapping table in the memory of the NDSMR server, where this data field contains data indicative of the basic nature of the information held in the file or resource to which the pointer is directed. For the purposes of this specification, the term "associated" implies that the data field is either in a direct one-to-one mapping relationship with the pointer or, alternatively, is integrated with the pointer address to form the actual pointer data structure. In a very specific embodiment, the data field

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associated with the pointer, indicative of the basic nature of the information pointed to, can contain codes normally used by physicians to categorise treatment events that they have administered to patients. Those codes are normally used for remuneration purposes, however, they can be employed here in a satisfactory manner as indicators of the nature of the medical data. Alternatively, the data field associated with the pointer may also contain the date and time at which the pointer was created (enabling the display of the information at the client workstation to be effected in a chronological order), a textual description of the medical information pointed to, a brief description of the status/results of the medical information pointed to, etc.

To facilitate the reading of the information associated with the pointers, namely the basic nature of the medical data, the display of the pointers may be organized and enhanced to enable the user to easily grasp the meaning of the data without the necessity to refer to lists cross-referencing codes with the basic nature of the medical data. This can be accomplished in several ways. For instance, the pointers related to the same information, for instance containing the address of files that hold electrocardiograms, may be displayed on the client workstation in a separate window and arranged in that window in chronological order. Another possibility is to display besides each pointer an icon or text box with the suitable data. This can be accomplished by providing the clients workstation with a table that maps the code in the pointer identifying the basic nature of the medical data with the type of information to be displayed to the user. When the NDSMR is loaded from the remote server 300, the list of pointers is identified and scanned to extract from them the codes identifying the basic nature of the medical data. The codes are then cross-referenced through the table with the corresponding information to be displayed. The information is then displayed on the screen of the user.

Another aspect of this invention is the update of the NDSMRs, following the creation of new medical data. This task could be effected by a NDSMR administrator, be it a medical archivist, webmaster or some other administrative appointee, also responsible

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for the maintenance and regular update of a local medical information system. Taking for example the medical archivist, it is known that within all of the healthcare establishments such archivists are currently responsible for ensuring a good upkeep of all local medical files, as well as for producing hospitalization summaries, and therefore are aware of all recent medical acts and treatments performed within their medical facility. An alternative to the use of NDSMR administrators is the implementation of automatic NDSMR updates, a process which would involve the incorporation of some sort of intelligence system into all local medical network information systems.

Figure 9 illustrates an example of a procedure to be followed by medical facility archivists in order to update the NDSMRs. Assume that the archivist within a particular medical facility receives on a regular basis a list of recent medical acts performed at the facility, as well as supporting documents for these acts. At step 902, the archivist updates the facility's local Intranet medical files and creates updated hospitalization summaries. The archivist's next step is to log on to the NDSMR server, using an archivist assigned password, at step 904. The server and its DBMS will recognize the archivist password and profile and assign privileges accordingly, as described above for steps 804 and 818 of the NDSMR server program element. For each different patient appearing on the archivist's updated list, a request must be made in order to retrieve the appropriate NDSMR. The request is made on the basis of the particular patient's identifier, submitted to the NDSMR server at step 906. At step 908, the NDSMR is downloaded to the archivist's workstation, at which point the archivist is capable of modifying and updating certain sections of the data contained in the NDSMR, for instance the Significant Antecedents, Current Medical Condition and Links To Other Biological Data categories as seen in Figure 6C. At step 910, the archivist refers to the updated list to update the NDSMR in order to reflect the individual's most recent and pertinent medical information, treatments and corresponding pointers. For example, assume that one of the archivist's list entries is that Mr. John Doe has undergone a new electrocardiogram at Hospital E. The archivist

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will then change the Most Recent Electrocardiogram reference seen in the Links To Other Biological Data category of Mr. Doe's NDSMR to point to the Hospital E local network, more particularly to the file containing the digitized electrocardiogram.

It is important to note that in order for the NDSMR system to function within an extended network of LANs or local Intranets, all documents referred to by pointers should be archived according to a specific nomenclature and be accessible outside of the LAN. In a most preferred embodiment of this invention, this specific nomenclature consists of that adopted by a state or national medical insurance company, thus ensuring record consistency and successful searches. The pointer addresses, transparent to the user, must also have a specific structure, to be respected by all archivists. In a most preferred embodiment of this invention, the structure of the pointer addresses, all the while respecting the URL addressing system, consists in a combination of a local network and machine address (or domain name), a patient's identifier, and a code taken from a published manual of medical act codes adopted by a state or national medical insurance company. There do exist alternatives to the specific nomenclature and pointer structure used by the NDSMR system, and the scope of this invention includes all other such variations whereby consistency is assured within the system.

Yet another feature of this invention is its use as a search/query engine. Not only can a user perform searches for or queries on NDSMRs within his/her own local Intranet, but also within external sources. NDSMR searches and queries may be performed on two different types of data, and therefore databases: nominative and non-nominative. Non-nominative medical data and databases are accessible to all authorized users, but do not require authorization from the patient whose personal data is being consulted. Nominative medical data and databases require search authorization from both the workstation client, typically a doctor or consultant, and the concerned patient, with the exception of situations where emergency medical care is required. The search requester will be prompted for this authorization through the workstation interface described above, the authorization comprising

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some form of password, biological signature or smart card. In the case where a search is performed by a user without nominative search authorization, the NDSMR Database Management System (DBMS) will automatically mask any nominative data found in the database response before transmitting it to the client workstation. In summary, the NDSMR system permits the delay-free consultation of pertinent information found within different local files and, for authorized users, offers an integrated research motor which allows for non-nominative research, by object or by concept, on the whole of the accessible databases.

Figure 10 displays the query usage allowed by the NDSMR system. From a client workstation, a user may make an initial query of the server 300. The server's DBMS and database logic allow the NDSMR database 302 to be searched rapidly and efficiently. The database logic is what allows the server to not only retrieve records on behalf of the client but also to perform searches on behalf of the client. We see in Figure 10 that an initial query returned 300 possible NDSMRs. The system allows the user to send out a second, more narrow query, with a resulting 25 NDSMRs returned. The system is therefore very efficient, especially for massive searches performed across all accessible databases. In a most preferred embodiment of this invention, the query style offered by the workstation interface will be one of relational data searches, such as the style currently offered by the Alta Vista (Trade mark) web browser. The query style will not be described in detail as it is very well known to a person skilled in the art. Alternatively, many other query styles could be incorporated into the NDSMR search engine, for instance an object-oriented search style.

The structure of the pointers as described above, where both an address part and an associated data part form a pointer, allows the NDSMR system to perform searches on all of the pointers contained within the NDSMR database, representing medical files archived at all of the various local networks connected within the extended health network. As mentioned above, the data structure of the pointers allows the nature of the information to which they point to be determined, either directly from the data structure

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itself in the case where both the data part and address part of the pointer are integrated to form the data structure of the pointer, or through a one-to-one mapping between the address part of the pointer's data structure and the data part, possibly stored in a mapping table in the memory of the NDSMR server. Consequently, medical searches performed on the NDSMRs will return all database records containing pertinent pointer links. These links will allow the user to research medical data from all over the health network, currently impossible but vital to progressive medical development. Thus a query could be made to extract records based on a key relating to the basic medical information. For example, one could extract the records of all individuals between the age of 25 - 35 that have undergone a particular therapy. This information is particularly useful in statistical studies.

As mentioned above, the use of a Smart Card as a unique network validated or attributed identifier for the NDSMR system users offers several implementation alternatives to the system. In a specific alternative embodiment of the invention, the Smart Card can be used at the client workstation in order to access the NDSMR database. For example, upon attempting to log onto the NDSMR system, the client, most likely a physician, will be prompted by the NDSMR system server (through the user-friendly interface seen at the workstation) to insert the patient's Smart Card into the workstation's appropriate electronic means. These electronic means read the information contained on the card and can extract the patient's identification. The NDSMR server's program element then passes control to its validation functional bloc in order to ensure that the patient is a server registered user, as described above. In another example, the NDSMR system server may prompt the client workstation user for two Smart Cards, both the physician's and the patient's, thereby increasing the security of the system.

The Smart Card may provide more than simple user identification. In another alternative embodiment of the invention, a patient's Smart Card contains medical information specific to the patient. In one example, the NDSMR system includes the Smart Card as a storage medium for system user information, with the NDSMR database records consisting strictly in at least one

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unique identifier and a dynamically updated list of pointers to relevant medical information located at remote locations. In such a system, the patient's Smart Card would contain all other medical information pertinent to the individual, for instance that shown in Figures 6A, 6B and 6C (minus the Links To Other Biological Data). Upon logging in to the NDSMR system with a Smart Card (or two), the medical information stored on the patient's Smart Card would appear on the client workstation, along with the list of pointers downloaded from the patient's record in the NDSMR database. In another example, a patient's nominative information could all be stored on the Smart Card, with only the patient's non-nominative information stored in the NDSMR database along with the identifier(s) and the list of pointers. This particular implementation of the system would ensure that no queries/searches performed on the NDSMR database revealed any confidential, nominative patient information.

A patient's Smart Card, or alternatively any other form of portable computer readable storage medium, may also be used to store and maintain all or a portion of the data found in the particular patient's NDSMR, where this data may be nominative, non-nominative, static or dynamic. In such a situation, the NDSMR server offers a continuously available means of update for the Smart Card, the update consisting in reading the latest information from the NDSMR and writing it to the Smart Card via the appropriate electronic means, without changing any of the static or nominative data stored on the card. This implementation would allow a physician, at a hospital external to the NDMSR system's integrated health network, to have access to the individual's pertinent and most recent medical information, the only requirement being that the hospital must have the appropriate electronic means to read the individual's Smart Card. A variety of other NDSMR system implementations also exist, distributing the whole of the patients' medical information between database records and patient Smart Cards or other such portable computer readable storage media, and are included within the scope of this invention.

The above description of a preferred embodiment under the present invention should not be read in a limitative manner as

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refinements and variations are possible without departing from the spirit of the invention. The scope of the invention is defined in the appended claims and their equivalents.

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I Claim:

1. A computer readable storage medium holding a data structure, said data structure comprising at least one record associated with a certain individual, said record including:

   - at least one unique identifier associated with the certain individual;

   - at least one pointer, said pointer using the URL addressing system to indicate the address of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

   - at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

2. A computer readable storage medium as defined in claim 1, wherein the pointer in said record points to medical data.

3. A computer readable storage medium as defined in claim 2, wherein said record is a medical record for said certain individual.

4. A computer readable storage medium as defined in claim 3, wherein said record includes a collection of data elements containing information of a medical nature for the certain individual.

5. A computer readable storage medium as defined in claim 1, wherein said record includes a plurality of pointers, one of said plurality of pointers being indicative of an address of a first location, another one of said pointers being indicative of an address of a second location that is remote from the first location.

6. A computer readable storage medium as defined in claim 5, wherein the first and the second locations are different nodes

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in a network.

7. A computer readable storage medium as defined in claim 6, comprising a multitude of records.

8. A computer readable storage medium as defined in claim 7, wherein said computer readable storage medium resides on at least one server in a network.

9. A computer readable storage medium as defined in claim 1, wherein said unique identifier is a derived biological signature of the certain individual.

10. A network server, including:

- a processor;
- a memory including:

a) a plurality of records associated with respective individuals, said record including:

iv) at least one unique identifier associated with the respective individual;

v) at least one pointer, said pointer using the URL addressing system to indicate the address of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

vi) at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

b) a program element including individual instructions, said program element implementing a functional block comprising means responsive to a request to transfer a particular record of said

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plurality of records towards a client connected to said server through a data communication pathway for locating the particular record and transferring the record toward the client over the data communication pathway.

11. A server as defined in claim 10, wherein the pointer in said record points to medical data.

12. A server as defined in claim 11, wherein said record is a medical record for the respective individual.

13. A server as defined in claim 12, wherein each record includes a collection of data elements containing information of a medical nature for the respective individual.

14. A server as defined in claim 10, wherein each record includes a plurality of pointers, one of said plurality of pointers being indicative of an address of a first location, another one of said pointers being indicative of an address of a second location that is remote from the first location.

15. A server as defined in claim 14, wherein the first and the second locations are different nodes in a network.

16. A network system for distributed storage of records, said network system including:

- at least one server managing a database, said database containing a plurality of records of respective individuals, each record including:

  a) at least one unique identifier associated with the respective individual;

  b) at least one pointer, said pointer using the URL addressing system to indicate the address of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

  c) at least one data field, said data field

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associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

- a plurality of nodes remote from said server, said nodes being connected to said server through data communication pathways, said nodes constituting locations pointed to by pointers in records of said database and including machine readable storage media holding the additional data pointed to by pointers in record of said database.

17. A network system as defined in claim 16, wherein the pointer in said record points to medical data.

18. A network system as defined in claim 17, wherein said record is a medical record for the respective individual.

19. A network system as defined in claim 18, wherein each record includes a collection of data elements containing information of a medical nature for the respective individual.

20. A network system as defined in claim 19, wherein each record includes a plurality of pointers, one of said plurality of pointers being indicative of an address of a first location, another one of said pointers being indicative of an address of a second location that is remote from the first location.

21. A network system as defined in claim 16, wherein said network system includes a plurality of servers managing said database.

22. A method for performing information queries within a network system, said network system including:

- at least one server managing a database, said database containing a plurality of records of respective individuals, each record including:

    a) at least one unique identifier associated with the respective individual;

    b) at least one pointer, said pointer using the URL addressing system to indicate the address

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of a location containing data for the certain individual, said address being in a form such that a machine can access the location and import the data from the location;

c) at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

- a plurality of nodes remote from said server, said nodes being connected to said server through data communication pathways, said nodes constituting locations pointed to by pointers in records of said database and including machine readable storage media holding the additional data pointed to by pointers in records of said database, said method comprising the step of processing the data fields associated with the pointers of said records to extract information.

23. A method as defined in claim 22, wherein the pointer in said record points to medical data.

24. A method as defined in claim 23, wherein said record is a medical record for the respective individual.

25. A method as defined in claim 24, wherein each record includes a collection of data elements containing information of a medical nature for the certain individual.

26. A method as defined in claim 25, wherein said method comprises the step of performing a search on all of the medical information included in the collection of data elements, for the plurality of medical records stored in the database.

27. A method as defined in claim 26, wherein said method comprises the step of performing a search on all of the non-nominative medical information included in said collection of data elements, for the plurality of medical records stored in the database.

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28. A method for updating a certain individual's computer readable storage medium with data held in a network server, said network system including:

- a processor;
- a memory including:

a) a plurality of records associated with respective individuals, said record including:

i. at least one unique identifier associated with the respective individual;

ii. at least one pointer, said pointer using the URL addressing system to indicate the address of a location containing data for the respective individual, said address being in a form such that a machine can access the location and import the data from the location;

iii. at least one data field, said data field associated with said pointer, said data field being indicative of the basic nature of the data at the location pointed to by the said pointer.

b) a program element including individual instructions, said program element implementing a functional block comprising means responsive to a request to transfer a particular record of said plurality of records towards a client connected to said server through a data communication pathway for locating the particular record and transferring the record toward the client over the data communication pathway.

29. A method as defined in claim 28, wherein the pointer in said record points to medical data.

30. A method as defined in claim 29, wherein said record is a

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medical record for the respective individual.

31. A method as defined in claim 28, wherein the computer readable storage medium contains a portion of the medical data stored in the record of the respective individual.

32. A method as defined in claim 28, wherein said computer readable storage medium is a Smart Card.

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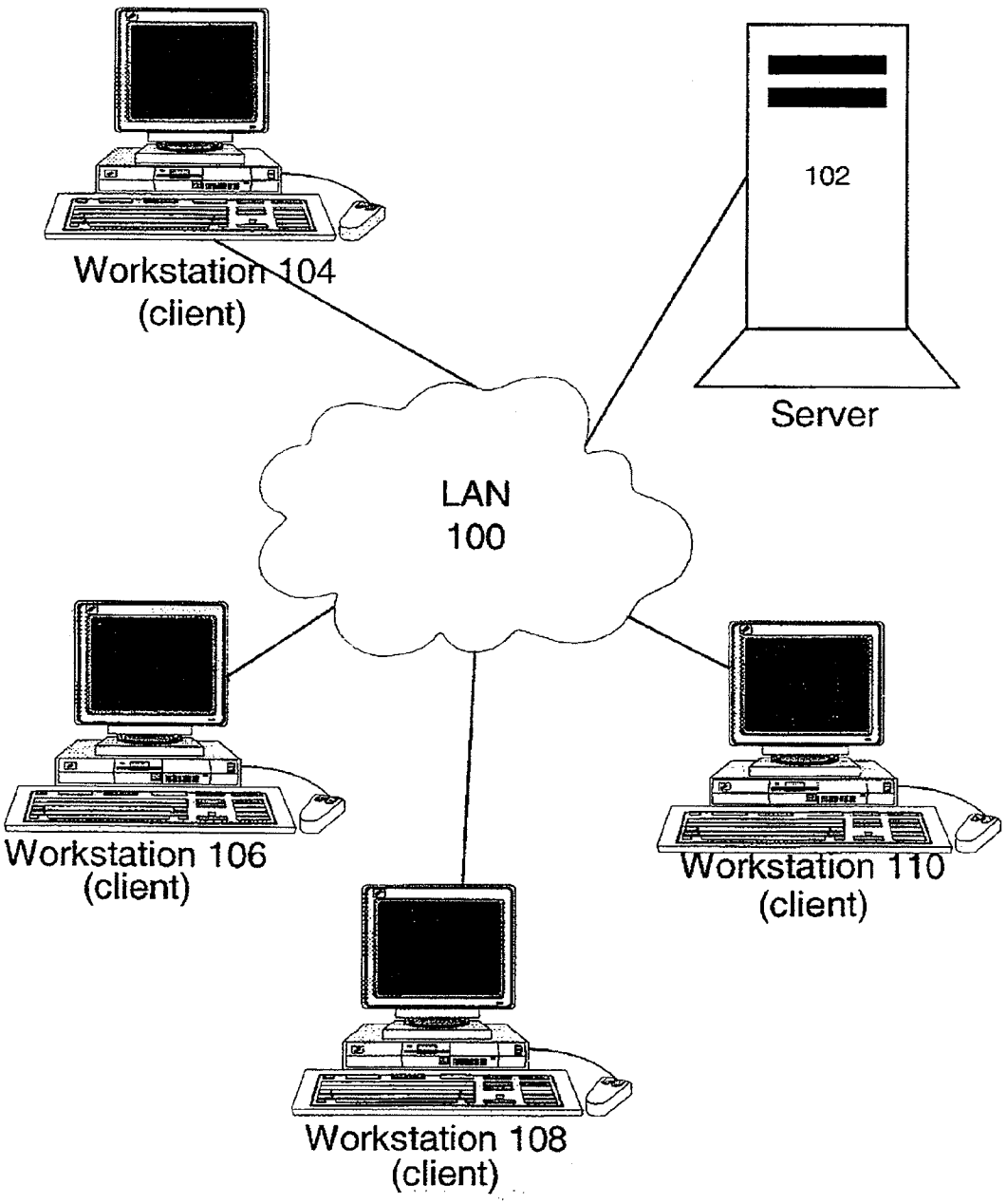
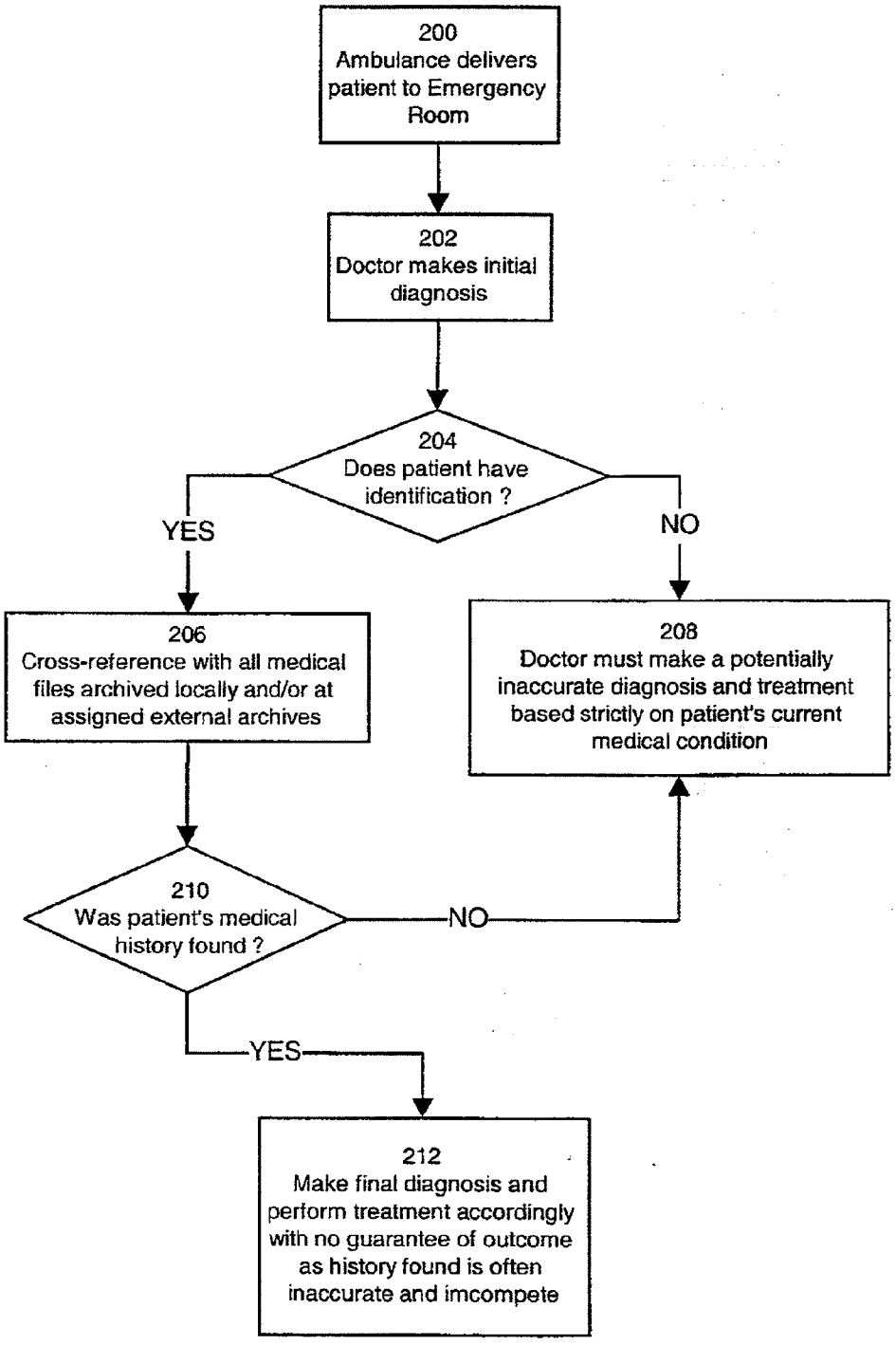


Figure 1

BNSDOCID: <WO_____9944162A1_I_>



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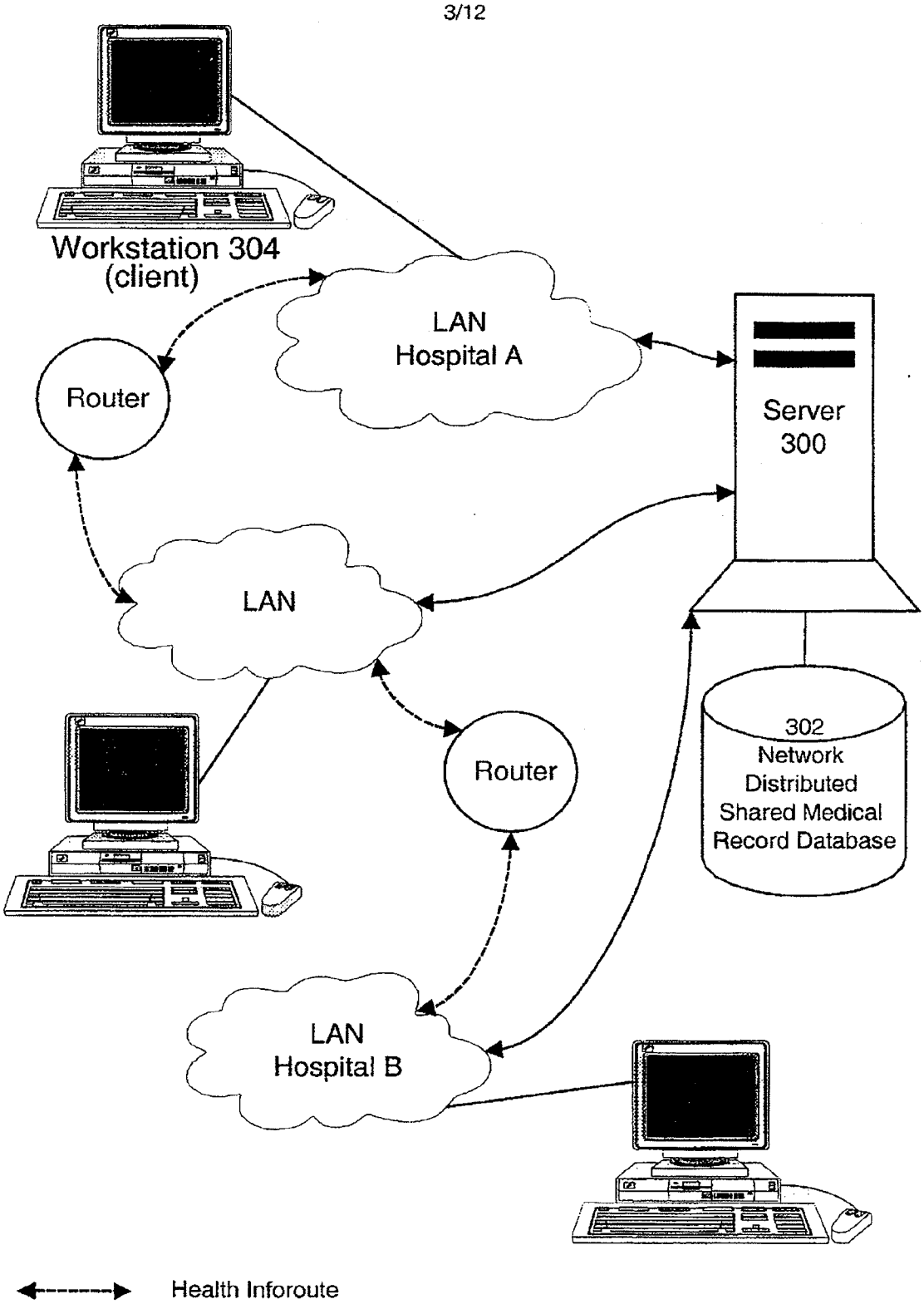

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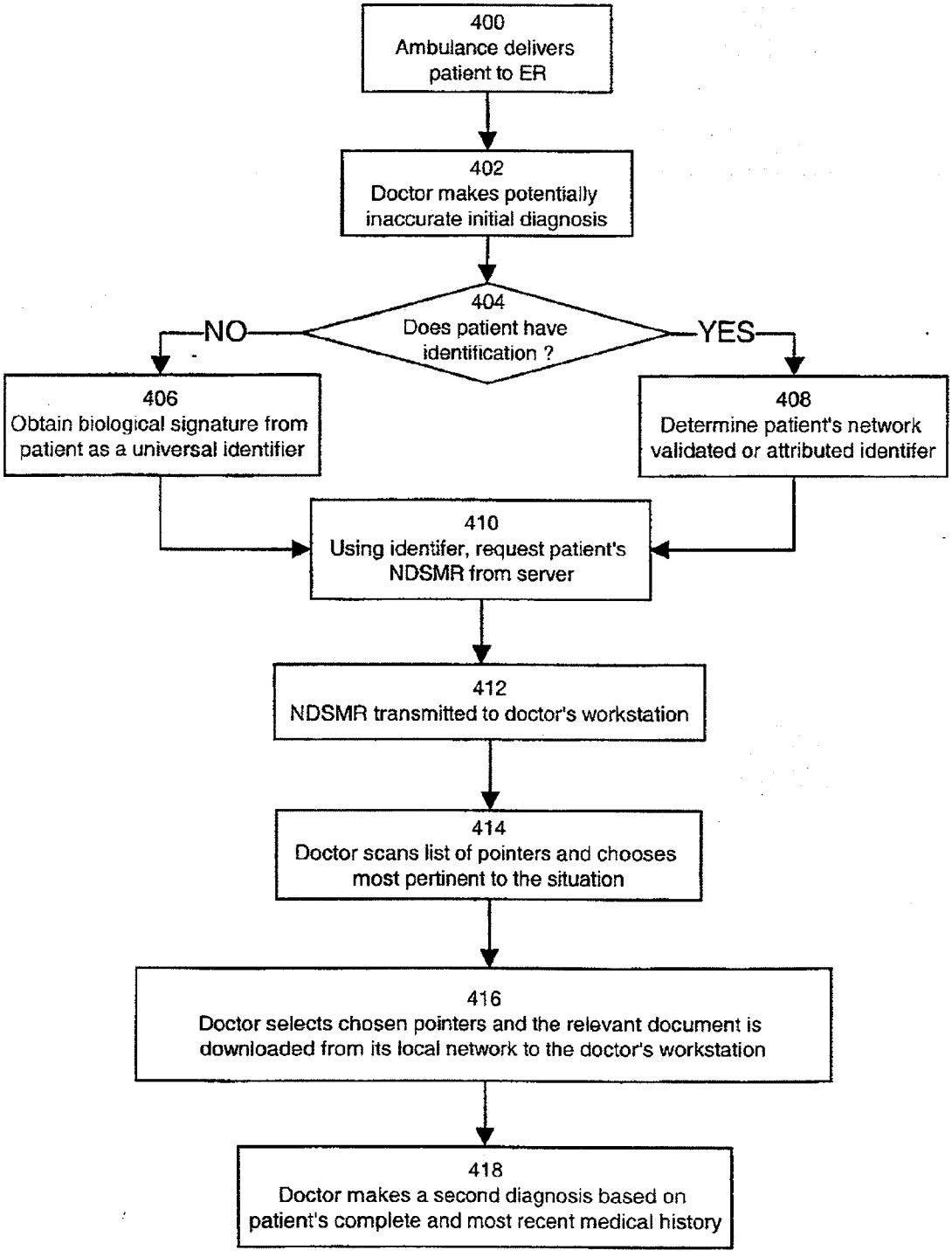

Figure 4

BNSDOCID: <WO_____9944162A1_I_>

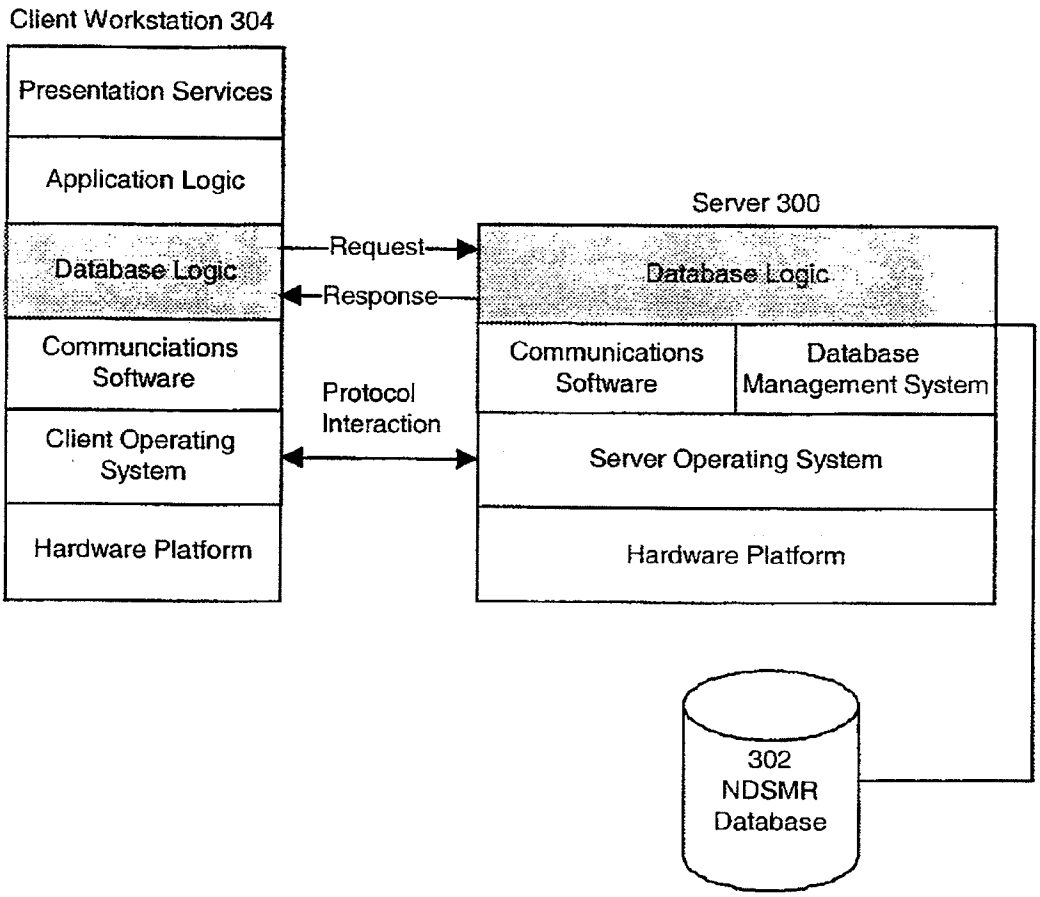

Figure 5

BNSDOCID: <WO_____9944162A1_I_>

CONFIDENTIAL MEDICAL FILE

LAST UPDATE: January 3 1998

SUBJECT: John Doe

IDENTIFIER: **** **** ****

GO TO:

Administrative Medical Data:	Administrative
Permanent Biological Data:	Biological
Significant Antecedents:	Antecedents
Current Medical Condition:	Current
Links to Other Biological Data:	Other_Links

Figure 6A

BNSDOCID: <WO_____9944162A1_I_>

Administrative Medical Data

Back to Main Menu Menu

HOME
Address:
Telephone:

WORK
Address:
Telephone:

EMERGENCY CONTACT
Name:
Telephone:
Relationship:

REGULAR PHYSICIAN
Name:
Telephone:
Relationship:

OTHER
Date of Birth:
Maiden Name of Mother:
Name of Father:
Status (Single or Married):
Name of Spouse (if applicable):

Permanent Biological Data

Back to Main Menu Menu

Blood Type:
Genetic Markings or Deficiencies:
Tissue Antigens:

Figure 6B

BNSDOCID: <WO_____9944162A1_I_>

Significant Antecedents

Back to Main Menu Menu

PERSONAL MEDICAL HISTORY
Past Hospitalizations:
Major Treatments Incurred:

FAMILY HISTORY
Antecedents:

SURGICAL HISTORY
Antecedents:
Interventionist Radiology Procedures:
Genetic Alterations:
Summary of Past Operation Protocols and Procedures:

Current Medical Condition

Back to Main Menu Menu

Allergies:
Medication(s) Used:

Links To Other Biological Data

Back to Main Menu Menu

MOST RECENT CORONAROGRAPHY	PREVIOUS CORONAROGRAPHIES
MOST RECENT ELECTROCARDIOGRAM	PREVIOUS ELECTROCARDIOGRAMS
MOST RECENT X-RAY	PREVIOUS X-RAYS
MOST RECENT BRAIN CT SCAN	PREVIOUS BRAIN CT SCANS

Figure 6C

BNSDOCID: <WO_____9944162A1_I_>

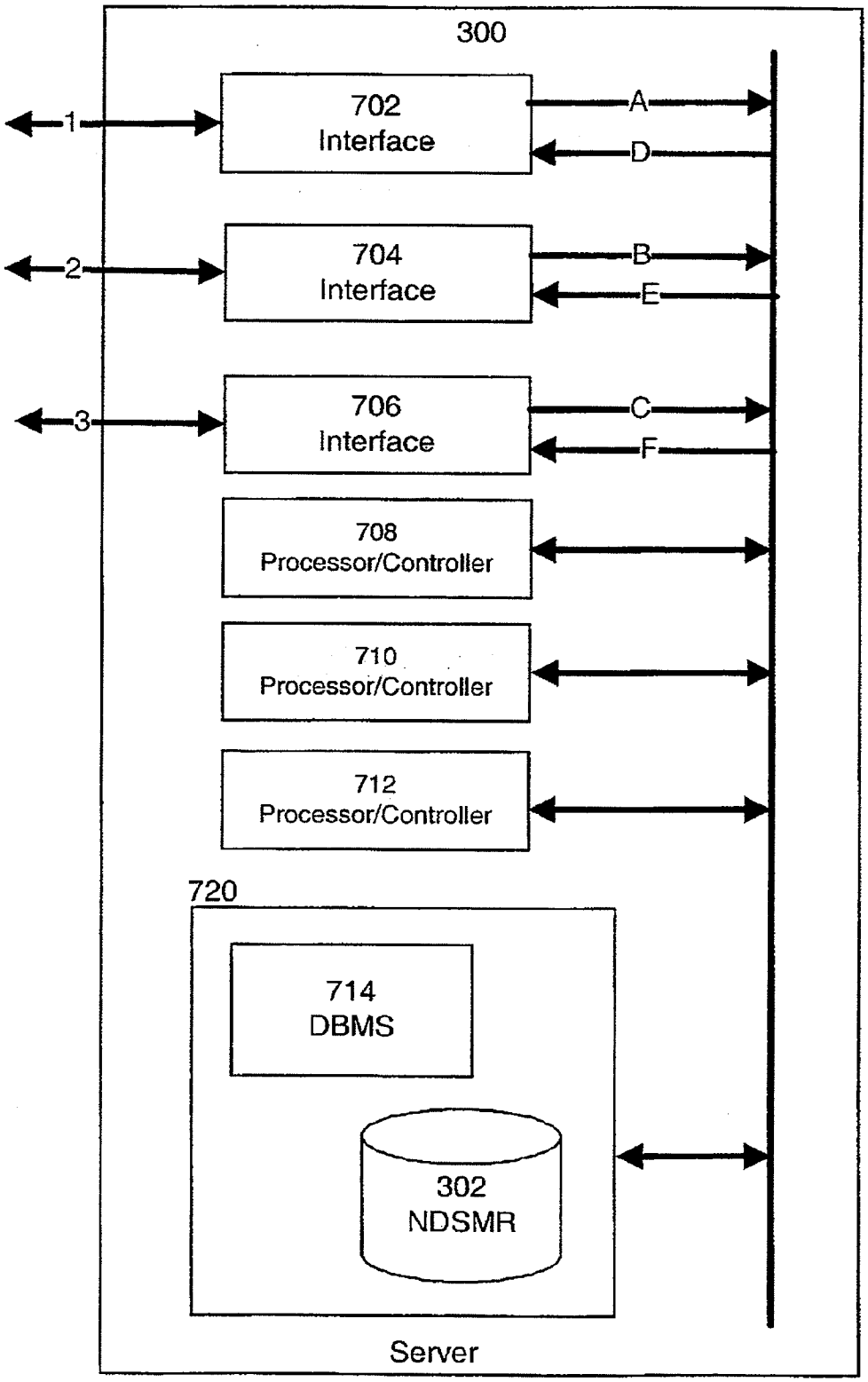

Figure 7

BNSDOCID: <WO_____9944162A1_I_>

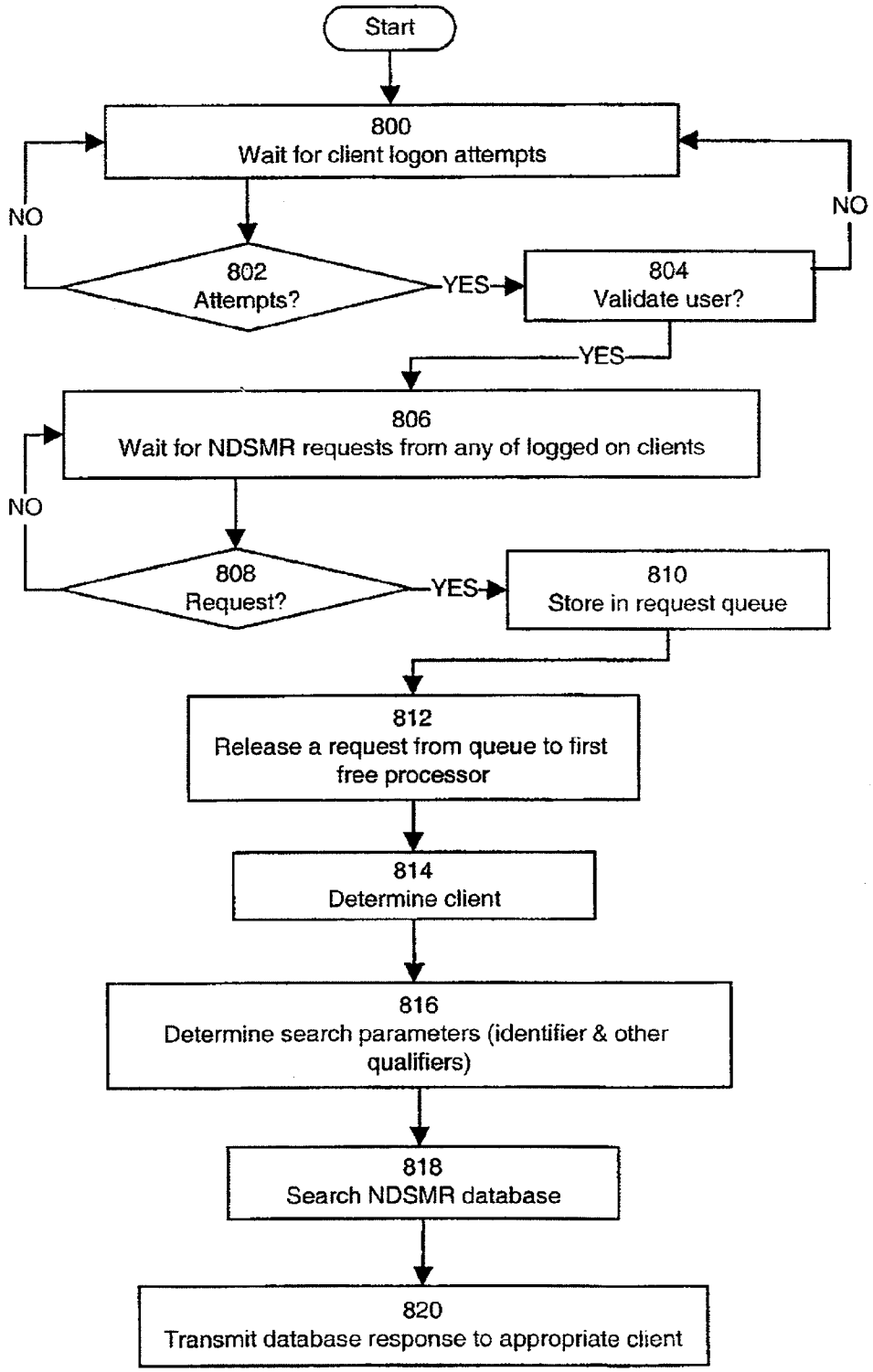

Figure 8

BNSDOCID: <WO_____9944162A1_I_>

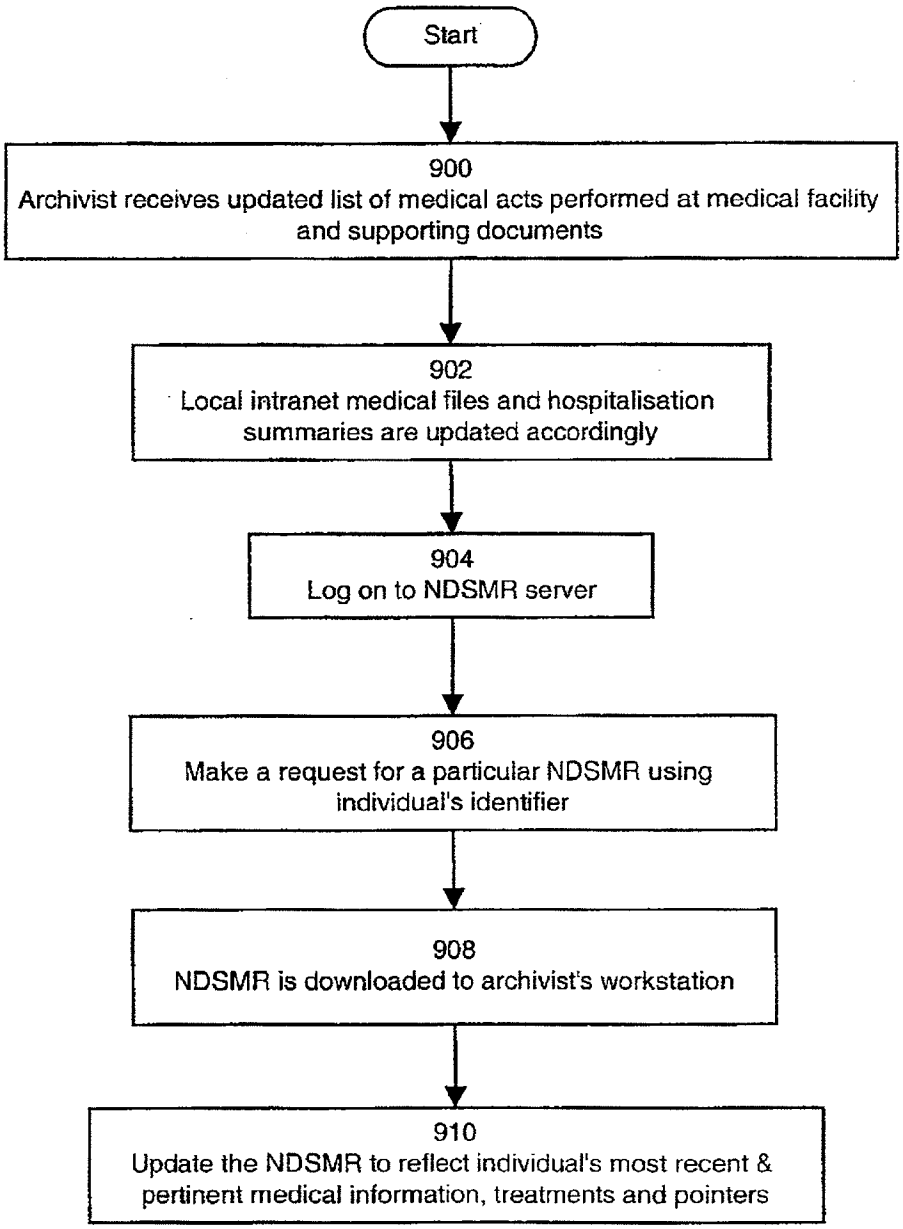

Figure 9

BNSDOCID: <WO_____9944162A1_I_>

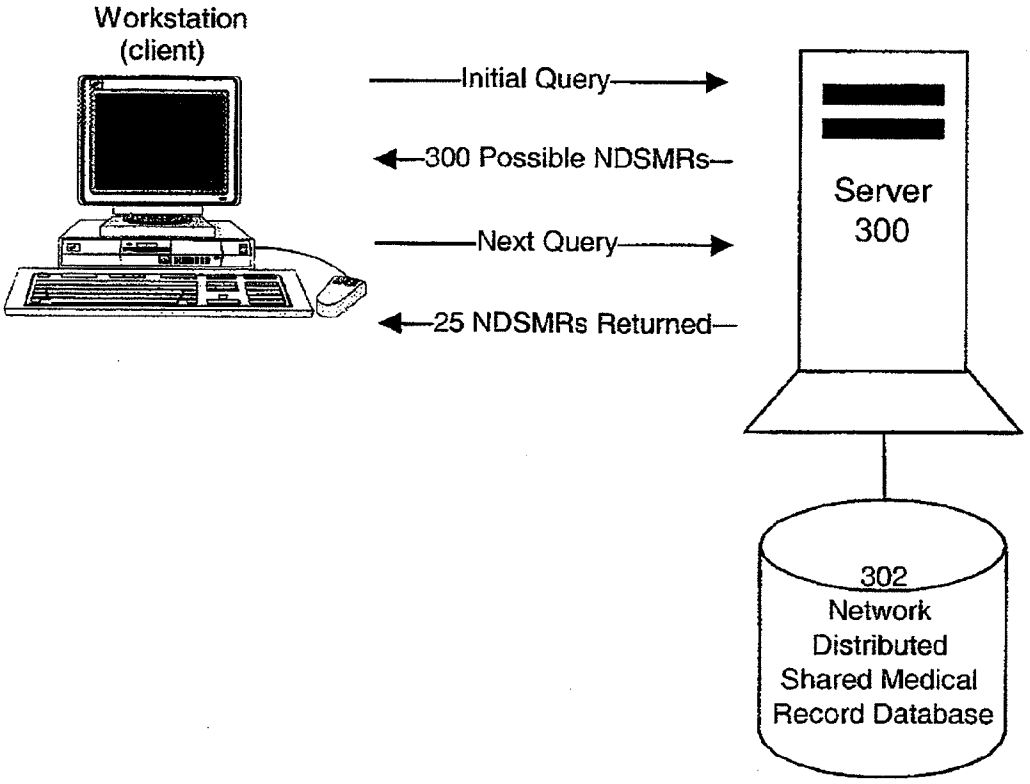

Figure 10

BNSDOCID: <WO_____9944162A1_I_>

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 98/01198

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F17/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GRIMSON, J ET AL.: "Interoperability Issues In Sharing Electronic Healthcare Records - the Synapses Approach" 3RD IEEE INTERNATIONAL CONFERENCE ON ENGINEERING OF COMPLEX COMPUTER SYSTEMS, 8 - 12 September 1997, pages 180-185, XP002107736 see the whole document	1-32
P,X	GRIMSON W ET AL: "FEDERATED HEALTHCARE RECORD SERVER - THE SYNAPSES PARADIGM" INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS, vol. 52, no. 1/03, 1 October 1998, pages 3-27, XP000667552 see the whole document	1-32

-/--

[X] Further documents are listed in the continuation of box C.

[ ] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 July 1999	14/07/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Schmidt, A

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BNSDOCID: <WO_____9944162A1_I_>

INTERNATIONAL SEARCH REPORT

national Application No
PCT/CA 98/01198

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	JAGANNATHAN V ET AL: "CORBA-BASED AND WEB-BASED PATIENT RECORDS INTEGRATION" PROCEEDINGS. TOWARDS AN ELECTRONIC PATIENT RECORD INTERNATIONAL SYMPOSIUM ON THE CREATION OF ELECTRONIC HEALTH RECORD SYSTEM AND GLOBAL CONFERENCE ON PATIENT RECORD, vol. 2, 13 May 1996, pages 243-247, XP000645542 see the whole document	1-32
A	NASZLADY A ET AL: "Patient health record on a smart card" INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS, vol. 48, no. 1-3, 1 February 1998, page 191-194 XP004115321 see abstract	32
A	BISKUP J ET AL: "Cryptographic protection of health information: cost and benefit" INTERNATIONAL JOURNAL OF BIO-MEDICAL COMPUTING, vol. 43, no. 1, 1 October 1996, page 61-67 XP004015610 see abstract see paragraph 1 - paragraph 3	1-32
A	MORGER, O ET AL.: "Security Concerns for Mobile Information Systems in Health Care" 8TH INT WORKSHOP ON DATABASE AND EXPERT SYSTEMS APPLICATIONS, 1 - 2 September 1997, XP002107737 see abstract see paragraph 1 see paragraph 4 - paragraph 6	1-32

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

BNSDOCID: <WO_____9944162A1_I_>